FOUNDATION VENTILATION SYSTEM AND METHOD

TECHNICAL FIELD

[0001] The invention relates generally to foundation ventilation systems and methods of ventilating foundation areas.

BACKGROUND

[0002] Foundations of many buildings, such as buildings using pier and beam foundations, are oftentimes provided with an air or crawl space that underlies the flooring or dwelling areas of the building. These spaces are usually provided with enough clearance between the ground and flooring to allow entrance therein to facilitate access to ducting, plumbing, etc. that may be located beneath the flooring of the building.

[0003] In many environments, these spaces may become damp or moist from the moisture in soils or seepage of water from the exterior portions of the building. Additionally, during warmer periods, temperatures within these spaces may be much cooler than the exterior temperatures. With high humidity, these lower temperatures may result in the condensation of moisture in the air, increasing the dampness or moisture content of these spaces.

[0004] High moisture content within the crawlspace areas can be detrimental to the building or its foundation. The moisture can facilitate the growth of mold and mildew. It can even result in the rotting or decay of wooden structural elements, weakening the building or its foundation.

[0005] To facilitate ventilating of these spaces, most buildings are provided with crawl space vent openings. These are usually in the form of rectangular shaped openings formed in the foundation wall and merely rely on natural convection or non-forced air flow through the openings. A screen may be positioned within the opening to allow air to flow through the opening, but preventing animals, insects, debris and other objects from passing through the opening. In many cases, the screen or vent openings may be provided with a closure that can be selectively opened and closed when conditions warrant.

[0006] To facilitate ventilation of these crawlspaces, fans or air moving devices have been provided in these vent openings. Such prior art devices, however, are usually hardwired into a wiring system of the building. Such wiring systems are usually provided at a relatively high voltage (egs. 120V or more), requiring a professional electrician or someone skilled with such wiring systems to install the devices without creating a risk of dangerous or lethal electric shock. Installation of

such ventilation devices is thus usually well outside the capabilities of most home owners.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying figures, in which:

[0008] FIGURE 1 is a perspective view of a foundation wall of a building, showing removal of an existing crawl space vent opening screen;

[0009] FIGURE 2 is a perspective view of a ventilation fan assembly of a ventilation system being installed within the vent opening of the foundation wall of Figure 1;

[0010] FIGURE 3 is cross-sectional side view of the foundation wall of Figure 2 with the fan assembly installed within the vent opening;

[0011] FIGURE 4 is a schematic representation of the ventilation system, constructed in accordance with the invention;

[0012] FIGURE 5 is a cross-sectional plan view of a foundation wall of a crawl space of a building with the ventilation system installed; and

[0013] FIGURE 6 is a non-vent-opening fan assembly for use with the ventilation system.

DETAILED DESCRIPTION

[0014] Referring to Figure 1, an exterior foundation wall 10 of a crawl space of a building is shown. The wall 10 is provided with one or more crawl space vent openings 12 to allow the passage of air between the exterior and interior of the crawl space. The openings 12 are typically rectangular in shape and may be of standardized dimensions (egs. 8" x 16") to facilitate mounting of pre-manufactured vent screens, such as the vent screen 14. The vent screen 14 may substantially fill the opening 12. The screen 14 may be fixed within the opening 12 along one or more edges of the perimeter 16 using mortar or caulking 18 or other fastening or securing means.

[0015] Referring to Figure 2, a fan assembly unit 20 is shown that may be positioned within a crawl space vent opening, such as the opening 12, and may be used to replace the screen 14. The fan assembly unit 20 includes a main frame or housing body 22, which is received within the opening 12, as shown in Figure 3. The housing body 22 may have a generally rectangular "box-like" configuration with transverse upper and lower walls that are joined together by opposite left and right upright sidewalls to define an interior of the housing 22 for allowing passage of air therethrough. An outwardly projecting lip or rim 24 may be provided along the forward portion of the housing body 22. The relatively thin lip or rim 24 extends around the forward perimeter of the housing body 22 and has a rearward surface 26 (Fig. 3) that may generally abut against the exterior portion of the wall 10 immediately surrounding the opening 12 when the unit 20 is positioned therein.

[0016] Mounting screws or fasteners 27 may be provided in the forward portion of the housing body 22 to facilitate securing the fan assembly unit 20 within the opening 12. Such screws or fasteners 27 engage the perimeter 16.

[0017] The fan assembly 20 is provided with one or more low voltage fans 28. The fans used for each fan assembly may provide a total air flow capacity of from about 50 to about 500 cfm, more particularly from about 100 to about 500 cfm, and still more particularly from about 150 to about 300 cfm. In the embodiment shown, a pair of low voltage axial flow fans 28 is used. An example of a commercially

available low voltage fan having about a 100 cfm capacity is that available as Commonwealth™ Model FP-108/DC Brushless Fan, which has a capacity of about 98cfm. An example of commercially available low voltage fan having a capacity of about 200 cfm at16.8 watts is that available as the Model No. D17251V12M, from Symbang International, Inc., Taiwan. Other low voltage fans having the same or different capacities are also commercially available.

[0018] As used herein, the expression "low voltage" is meant to encompass a voltage of less than 60 volts. In particular, low voltage may include a voltage of less than 50 volts, more particularly less than 30 volts, and may include a voltage of about 12 volts or 24 volts, which is used for low voltage systems that are in commonly employed within the United States today. Low voltage may include that which may be readily employed with wiring of 16, 18 gauge or smaller diameter wire. The low voltage may not create dangerous or lethal electric shock upon exposure.

[0019] The fan or fans 28 are mounted to the main housing 22 and may be housed within a fan housing 30. The fan housing 30 may include a screen or other device that allows passage of air therethrough and that may prevent matter or other objects from passing through the interior of the housing 30 from the rear and into contact with the fans 28.

[0020] A set of louvers or other closure 32 may be mounted to and housed within the housing 22. The closure 32 may be selectively closed or opened to allow or prevent passage of air through the interior of the housing 22. A lever or other mechanism 34 may be provided to facilitate opening and closing of the closure 32 from the exterior side of the foundation wall 10 when the fan assembly 20 is mounted therein.

[0021] A forward grate or screen 36 may also be provided that generally extends across the housing interior and prevents the passage of objects and matter through the front of the housing 30. The grate or screen 36 may be recessed slightly from the forward edge of the housing 22. A secondary screen 38 may also be provided that extends across the housing interior to the rear of the grate 36. The secondary

screen 38 may have smaller openings or be of finer mesh screen to prevent the passage of smaller objects or material through the housing interior.

[0022] A low voltage tap wire assembly 40 is provided with the fan assembly 20. The wire assembly 40 includes a length of low voltage electrical cord 42 that is coupled at one end to the low voltage fan or fans 28 for supplying electrical power thereto. The cord 42 may have a length of from about 1 to about 5 feet. A selectively-positionable electrical connector 44 (Fig. 4) is also provided at the opposite end of the cord 42. The connector 44 may include an insulation penetrating connector. An example of such a connector is that commercially available as 3M™ Scotchlok™ 560 Insulation Displacement Connector (IDC), Double Run or Tap connector, available from 3M Company. The connectors 44 are those that can be positioned generally anywhere along the continuous length of a low voltage electrical cord (run wire) without cutting of the cord to which they connect and while still making an electrical connection for the passage of current between the electrical cords or wires (run and tap) that are being joined together and that may still provide insulation for the connection.

[0023] Referring to Figure 4, a ventilation system 46 is shown that incorporates three of the fan assemblies 20, as previously described. The system 46 includes a single, high-voltage electrical cord 48 having a plug 50 at one end for plugging into an electrical outlet of an exterior electrical socket connected to high voltage power source associated with the building for which the ventilation system 46 is being used. The high voltage power source may include a 120 volt system, which are commonly employed in buildings or dwellings within the United States.

[0024] Coupled to the high voltage cord 48 opposite the plug 50 is a voltage reducing device 52, such as voltage transformer. The device 52 may include a 12 volt DC transformer for reducing the voltage from and also for converting AC current to DC, if desired. An example of a suitable commercially available voltage reducing device is the Malibu ML80P transformer, available from Intermatic, Inc.

[0025] The voltage reducing device 52 locates exterior to the wall 10 and to the crawlspace. The device 52 provides a low voltage output that is conducted by means of low voltage wire or cord 53 to a controller 54, which is also located

exterior of the crawlspace. The controller 54 is provided with temperature and humidity sensors 56, 58 for measuring and monitoring temperature and humidity conditions exterior to crawlspace interior. Additionally, a timer may also be provided with the controller 54.

[0026] The device 52 also provides a low voltage electrical output through a length of low voltage electrical cord 60 for conducting electrical current to the fan assemblies 20. This may be coupled through the controller 54 so that the controller 54 regulates the current from the transformer 52 that is supplied through the cord 60. The cord 60 may be of 16, 18 gauge or smaller gauge wire suitable for use with low voltage electrical current. The cord 60 may be continuous and have a substantial length so that it may extend to spaced apart vent openings into which the fan assemblies may be mounted. This may be at least 25, 30, 40, 50, 100 feet or more. The cord 60 may initially be provided on a spool or other device (not shown) to facilitate storing of the cord prior to installation.

[0027] The low voltage cord 60 may be passed through the interior of the fan assembly housing 22 of one of the fan assemblies 20. A small passage or opening (not shown) formed in the screens or covers of the fan assembly housing may be provided to facilitate passage of the cord 60 in this manner. Alternatively, the low voltage cord 60 may be passed through a small hole or opening formed in the foundation wall 10, as shown in Figures 2 and 3. This may be near or adjacent an exterior electrical socket of the building to which the system is to be plugged.

[0028] The ventilation system 46 may be provided as a kit with the required components for ventilation of the crawl space of a dwelling or building prepackaged. The kit may be provided with each of the components discussed above, and may include 2, 3, 4 or more fan assemblies 20. The ventilation system kit may be provided with a varying number of fan assemblies in each kit based upon the square footage of the building or dwelling crawlspace for which it is intended to be used. Several different prepackaged kits may be provided for use with buildings or dwellings of different sizes. The ventilation system or kit may be installed with minimal effort without requiring a professional electrician or one

highly skilled with electrical wiring. Instructions on installation that may generally follow along the description which follows may be provided with the kit.

[0029] The number of fan assemblies provided with the kit or to be used with the ventilation system may be based upon the amount of air that needs to be circulated through the crawlspace. A ventilation system that circulates one crawlspace volume of air every 3 to 15 minutes or more may be suitable. As an example, an 1800 square foot crawlspace having a crawlspace height of approximately 3 feet would have a crawlspace volume of about 5400 ft^3. A ventilation system with four fan assemblies 20 having a flow capacity of about 200 cfm each would thus circulate a 5400 ft^3 volume of air every 6.75 minutes. With five fan assemblies 20 at 200 cfm each, the 5400 ft^3 volume of air would be circulated every 5.4 minutes.

[0030] Installation of the ventilation system 46 may be carried out as follows. A determination is made of the number and location of crawl space vent openings 12 of the building or dwelling for which the ventilation system is to be installed. Additionally, it may be desirable to determine the approximate square footage of the crawlspace. One fan assembly may be used for each approximately 300 to 600 square feet, or more particularly, each approximately 400 to 500 square feet area. Thus, for an 1800 square foot crawlspace, approximately 3 to 6 fan assemblies may be used, more particularly 4 to 5 fan assemblies. This may vary depending upon the available vent openings 12, however.

[0031] Referring to Figure 5, the fan assemblies are preferably placed generally on one side of the building or dwelling. Vent openings opposite these will be free of any fan assemblies, but may be left opening to facilitate cross ventilation and introduction of fresh exterior air, as shown by the arrows 62.

[0032] Upon a determination of which vent openings 12 will be provided with the fan assemblies 20, any existing screen, such as the screen 14, is removed. Any existing mortar or caulking 18 that may surround the screen to secure it within the opening 12, may be removed, as shown in Figure 1. The fan assemblies 20 are then mounted into the selected vent openings 12, with the tap assemblies 40 passing through the rear of the opening 12 into the interior of the crawl space. When placed within the openings 12, the lip or rim 24 will abut against the exterior of the

foundation wall 10 immediately surrounding the opening 12 to provide a generally flush and finished appearance. The screws or fasteners 27 may then be tightened or engaged to fix the fan assemblies in place within the openings 12.

[0033] A high voltage exterior electrical outlet is located to which the plug 50 may be plugged. If the electrical outlet is located adjacent to one the screen openings 12 to which the fan assembly will be mounted, the configuration wherein the cord 60 passes through the housing 22 (not shown) may be used. Alternatively, in situations where the exterior electrical outlet is remote from such a screen opening, a small hole (Figures 2 and 3) may be drilled through the wall 10 adjacent to the electrical outlet. The end of the cord 60 may then be passed through the formed hole or opening formed in the wall 10 and into the interior of the crawl space. The cord 48 should remain unplugged from the exterior electrical outlet until installation is complete and the ventilation system is ready to be operated.

[0034] The transformer 52 and attached controller 54 may be positioned adjacent the wall 10 exterior of the crawl space. The low voltage cord 60 is then passed or extended into the interior of the crawl space to reach adjacent to each of the vent openings to which the fan assemblies 20 are mounted so that the cord 42 may be electrically coupled to the cord 60.

[0035] The fan assembly cord 42 for each fan assembly 20 is tapped or coupled to the low voltage cord 60 by means of the connectors 44. The connectors 44 may make electrical connection between the conductors of the cords 60 without requiring any stripping or exposing of the insulation surrounding the wire. The connectors 44 may be secured by merely crimping with a pliers or other crimping device so that the contact of such connector 44 pierces or penetrates the insulation and makes contact with the conductors of both the tap and run wires, without requiring stripping or cutting of the cord 60. This is done for each of the fan assembly units 20.

[0036] When each of the fan assemblies 20 is electrically connected to the cord 60, the ventilation system 46 is installed. The plug 50 may be plugged into the high voltage electrical outlet associated with the building where the transformer 52 reduces the power output to the controller 54 to a low voltage output.

[0037] The controller 54 regulates the low voltage output to the fan assemblies 20 through the cord 60. The controller 54 senses outside temperature and humidity conditions by means of thermostat and humidistat 56, 58. As an example of one mode of operation, when exterior temperatures sensed by the thermostat 56 are above about 40°F and relative humidity is below 80%, current is provided to power the fans 28. Such temperature and humidity settings may be varied, however. This causes air to be forcibly expelled through the vent openings 12. Air is also drawn into the non-modified vent openings 12A, 12B, 12C that are free of fan assemblies, as shown Figure 5.

[0038] When the exterior temperature drops below 40°F or the humidity rises above 80%, the controller 54 causes power to the fan assemblies 20 to be cut off. This prevents cold or humid exterior air from being drawn into the crawl space, such as through the non-modified vent openings 12A, 12B, 12C. Additionally, the louvers 32 may also be closed to prevent passage of air through the interior of the housing.

[0039] In another embodiment, a timer (not shown) may be provided with the controller 54. The timer may be set so that the fans are powered at certain times of the day, such as during the day when exterior air temperature may be warmer or less humid.

[0040] Referring to Figure 6, a non-vent-opening fan assembly 64 is shown. The non-vent-opening fan assembly 64 is provided with a low voltage fan or fans 66, which may be similar to the fans 28 of the fan assemblies 20. The fan 66 is joined to an arm 68 that may have a bracket 70 or other mounting means configured for coupling or securing to floor joist 72 or other structural element of the crawl space. The assembly 64 may also be staked in earth or soil of the crawl space or be otherwise supported thereon. The fan assembly 64 may be coupled to the low voltage electrical cord or wiring 60 in a manner similar to the fan assemblies 20. The fan assembly 64 is provided with a tap assembly 74, which may be similar to the tap assembly 40, to accomplish this. One or more of such non-vent opening fan assemblies 64 may be secured in such fashion as part of the ventilation system 46 and may be provided as part of the prepackaged ventilation system kit, as well.

[0041] The non-vent-opening fan assemblies 64 may be positioned in areas or pockets of dead air space that may be located under the crawl space or other areas of the building or dwelling. These areas may be remote from any vent openings 12 and may be isolated from cross flow air or air that is drawn by the fan assemblies 20. The fan assemblies 64 may be positioned and directed to facilitate the movement of air out of these areas or pockets into the air stream drawn by the fan assemblies 20 of the vent openings 12.

[0042] In another configuration and mode of operation, the non-vent-opening fan assemblies 64 may be used in place of the fan assemblies 20. In such a configuration, one or more fan assemblies 64 may be positioned near or adjacent to existing vent openings 12 by attaching them to a joist or other structural member of the crawl space or by staking or being otherwise supported thereon. The vent openings 12 may be provided with a vent screen, such as the conventional vent screen 14 of Figure 1. The fan assemblies 64 may be arranged similarly to the fan assemblies 20, as shown in Figure 5, generally along one side of the building crawl space to provide cross ventilation, as previously discussed. The fan assemblies 64 may thus direct air through the openings 12 without the removal of any existing screen or preexisting structure that may be located within the vent opening. Such ventilation system employing the fan assemblies 64 instead of the fan assemblies 20 may be operated and assembled in a similar manner to the ventilation system 46, incorporating the controller 54, voltage reducing device 52, etc.

[0043] While the invention has been shown in only some of its forms, it should be apparent to those skilled in the art that it is not so limited, but is susceptible to various changes and modifications without departing from the scope of the invention. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the invention.